The characterization soft and heterogeneous surfaces with map of elasticity properties obtained by atomic force microscopy method

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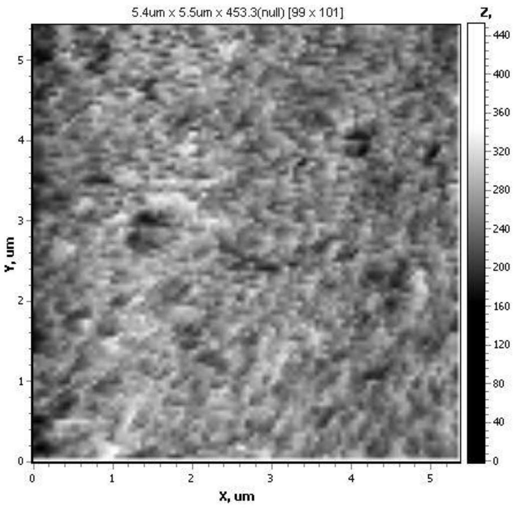
One of the important problems is to determine local mechanical properties heterogeneous surfaces by atomic force microscopy method [1]. The first task is to select a model for calculating the modulus of elasticity. We used the Tabor parameter to achieve that. For example, if we calculate using Jhonson – Kendall – Robertz model we can take into consideration adhesion force between cantilever and sample surfaces [2]. This model is more suitable for the polymeric materials, fixed and living biological cells [3].

As usual, objects are characterized by convexities and concavities. Characteristics are may also vary in different point of studied objects. At present researches did not take into consideration different types of influences on calculation of elasticity modulus. It is important to make an amendment for shape of the probe that is well described in F. Borodich's article [4]. Other corrections to make are angle under which the presser on the convexity is applied and interacting of the probe with the concavity. Consideration of all these corrections, as well as studying by constructing elasticity maps, allows us to minimize variance of elasticity for the surface being researched.

In our research we used two types of material – fixed biological cells (heterogeneous surface) and polydymethylsiloxane (PDMS, homogeneous surface). The distribution data of elasticity modulus PDMS surface 1x1 μm presented on Figure 1.

After addition these corrections elasticity modulus is decreased on 10 % in second case, and modulus decreased on 20 % for biological cell membranes and variance of values is minimized.



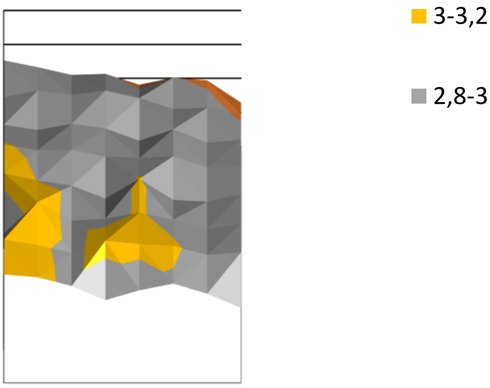


Figure 1. Structure in (a) Torsion and (b) elasticity modulus (MPa) of PDMS surface 1x1 μm.

1. E. Gorshkova et al., *Nanoindustry. Nanotechnology for medicine* **4**, 50 (2012). (In Russian)
2. S.A. Chizhik et al., *Langmuir* **14**, 2606 (1998).
3. G.B. Melnikova et al., *5th Eurosummer school on biorheology and symposium on micro and nanomechanics and mechanobiology of cells, tissues and systems*. **33** (2015).
4. F. Borodich, *Advances in Applied Mechanics* **47**, 225 (2014).